Port of Seattle

East Waterway, Harbor Island Superfund Site:
Phase 1 Removal Action

EAST WATERWAY PHASE 1 REMOVAL ACTION: RECONTAMINATION MONITORING 2007 DATA REPORT

For submittal to:

The US Environmental Protection Agency
Region 10
Seattle, WA

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Acronyms

AET	apparent effects threshold
ARI	Analytical Resources, Inc.
GC/ECD	gas chromatograph-electron capture detection
GC/MS	gas chromatograph-mass spectrometry
CCV	continuing calibration verifications
CSL	cleanup screening level
CVAA	cold vapor atomic absorption
DMMP	Dredged Material Management Program
EPA	US Environmental Protection Agency
EWW	East Waterway Operable Unit of the Harbor Island Superfund site
ICP-AES	inductively coupled plasma-atomic emission spectrometry
ID	identification
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PSEP	Puget Sound Estuary Program
RMP	recontamination monitoring plan
SDG	sample delivery group
SMS	Washington State Sediment Management Standards
SQS	sediment quality standards of SMS
SVOC	semivolatile organic compound
TOC	total organic carbon
Windward	Windward Environmental LLC

1.0 Introduction

This data report presents the second annual results for the chemical analyses conducted with surface sediment samples collected as part of the recontamination monitoring plan (RMP) (Windward 2005) for the East Waterway Phase 1 Removal Action Plan. This 2007 sampling focused on resampling locations where concentrations exceeded the corresponding CSL, placing additional samples in the vicinity of SQS exceedances from 2006, and expanding the spatial extent of sampling. These modifications and rationale for the 2007 sampling were discussed with EPA prior to sampling and were described in the 2007 RMP memorandum (Windward 2007). The 2005 RMP presented the sampling design and analysis plan, including details on project organization, field data collection, laboratory analyses, and data management. As described in the RMP, the data will be used to evaluate compliance with the cleanup standards identified in the Phase 1 Removal Action engineering evaluation and cost analysis, characterize surface sediment chemistry throughout the removal area, assess the thickness of the sand layer, and assess any changes in surface chemistry or sand layer thickness over time. This information will be used in the remedial investigation/feasibility study planned for East Waterway (EWW).

Sediment cores were collected at 18 locations to confirm the thickness of the sand layer. Surface sediment grab samples were collected for chemical analyses at 22 locations in the EWW Phase 1 Removal Action footprint in February 2007. All surface sediment samples were analyzed for polychlorinated biphenyls (PCBs), organochlorine pesticides, mercury and metals, and semivolatile organic compounds (SVOCs) listed in the Washington State Sediment Management Standards (SMS).

The remainder of this report is organized into the following sections:

- Section 2.0 –Sediment Core and Grab Sampling Methods
- Section 3.0 – Laboratory methods
- Section 4.0 – Results
- Section 5.0 – References

The text of this report is supported by the following appendices:

- Appendix A – Data tables
- Appendix B – Data management
- Appendix C – Data validation reports
- Appendix D – Raw analytical laboratory data
- Appendix E – Collection forms and field notes
- Appendix F – Chain-of-custody forms

2.0 EWW Sediment Core and Grab Sampling Methods

This section presents the surface sediment sample identification (ID) scheme, sample locations, collection methods, and field deviations from the RMP (Windward 2005) for samples collected in the EWW in February 2007. Additional details regarding the surface sediment collection methods are presented in the RMP. Copies of field notes, surface sediment collection forms, and protocol modification forms are presented in Appendix E. Copies of completed chain-of-custody forms used to track sample custody are presented in Appendix F. Photographs of the sediment cores are provided on a compact disk (located in a pocket inside the back cover).

2.1 SAMPLE IDENTIFICATION SCHEME

Each sampling location was assigned a unique alphanumeric location ID number. The first four characters were "EW-RM" to identify the EWW recontamination monitoring event. The last characters were either -04, -10, -15, or -27 to indicate 2006 locations that were being re-occupied or were consecutive numbers between 29 and 47 to identify new 2007 specific locations (e.g., EW-RM-29). Sample IDs were consistent with the location IDs but also included the two-digit year after the event identifier. For example, a sample taken at location 29 this year was identified as "EW-RM07-29."

Field quality assurance/quality control samples were assigned modified sample identifiers as described below:

- Field duplicates were assigned a unique sample location number beginning with 101 (e.g., EW-RM07-101).
- Rinsate blanks were assigned the same characters as the sample identifier, followed by the identifier "RB." For example, the rinsate blank collected for sample EW-RM07-1 would be "EW-RM07-1-RB."

2.2 SAMPLING LOCATIONS

The rationale for selecting sediment core and surface grab locations is presented in the 2007 RMP memo (Windward, 2007). Sampling locations for the 2006 and 2007 recontamination monitoring are presented in Figure 1. The 2007 sampling was conducted February 6-8, 2007. Twenty three locations were sampled (Table 1). Depth core samples were collected at eighteen of these locations and surface grabs for chemical analyses were collected from twenty two of these locations. However, if there were less than 10 cm of sand layer observed at a core location or if there were at least 2 cm of material overlying the sand layer, then a sediment chemistry grab sample was collected at the location. Sampling locations and the depths of the sand layer and overlying material layer at each location are shown in Figure 2.

Table 1. 2007 EWW sediment core and grab sampling locations

Location ID	2007 Actual Sample ID	2007 RMP memo Sample ID	Zone[a]	Sample Date	Sample Time	Actual Coordinates[b]		Target Coordinates[b]		Distance Off Target (ft)	Sample Type
						(X)	(Y)	(X)	(Y)		
EW-RM-4[c]	EW-RM07-4[c]	EW-RM07-04	1	2/8/07	10:26	1267255	214433	1267258	214434	3.2	chemistry grab
EW-RM-10[c]	EW-RM07-10[c]	EW-RM07-5	2	2/8/07	14:16	1267524	214703	1267527	214703	3.0	chemistry grab
				2/7/07	10:33	1267526	214703			1.0	core
EW-RM-15[c]	EW-RM07-15[c]	EW-RM07-19	3	2/8/07	13:55	1267653	214861	1267653	214869	8.0	chemistry grab
				2/7/07	12:06	1267653	214868			1.0	core
EW-RM-27[c]	EW-RM07-27[c]	EW-RM07-23	2	2/8/07	9:25	1267658	215743	1267654	215744	4.1	chemistry grab
				2/7/07	15:37	1267655	215744			1.0	core
EW-RM-29	EW-RM07-29	EW-RM07-01	1	2/8/07	9:39	1267549	214213	1267547	214212	2.2	chemistry grab
EW-RM-30	EW-RM07-30	EW-RM07-02	2	2/8/07	10:08	1267703	214337	1267701	214337	2.0	chemistry grab
			2	2/7/07	9:30	1267703	214335			2.8	core
EW-RM-31	EW-RM07-31	EW-RM07-03	2	2/6/07	10:35	1267572	214407	1267571	214407	1.0	core
EW-RM-32	EW-RM07-32	EW-RM07-06	2	2/8/07	10:39	1267709	214692	1267709	214692	0.0	chemistry grab
				2/7/07	10:12	1267715	214688			7.2	core
EW-RM-33	EW-RM07-33	EW-RM07-07	2	2/8/07	11:19	1267314	214784	1267316	214786	2.8	chemistry grab
				2/6/07	11:28	1267318	214785			2.2	core
EW-RM-34	EW-RM07-34	EW-RM07-08	2	2/8/07	14:39	1267601	214840	1267601	214841	1.0	chemistry grab
				2/7/07	10:52	1267603	214843			2.8	core
EW-RM-35	EW-RM07-35	EW-RM07-09	3	2/8/07	11:09	1267682	214925	1267682	214924	1.0	chemistry grab
				2/7/07	11:36	1267686	214924			4.0	core
EW-RM-36	EW-RM07-36	EW-RM07-10	2	2/8/07	12:05	1267406	215052	1267413	215058	9.2	chemistry grab
				2/7/07	14:36	1267406	215052			9.2	core
EW-RM-37[d]	EW-RM07-37[d]	EW-RM07-11	2	2/8/07	15:00	1267605	215085	1267607	215084	2.2	chemistry grab

Location ID	2007 Actual Sample ID	2007 RMP memo Sample ID	Zone[a]	Sample Date	Sample Time	Actual Coordinates[b]		Target Coordinates[b]		Distance Off Target (ft)	Sample Type
						(X)	(Y)	(X)	(Y)		
				2/6/07	12:35	1267613	215084			6.0	core
EW-RM-38	EW-RM07-38	EW-RM07-12	3	2/8/07	12:55	1267717	215174	1267717	215174	0.0	chemistry grab
				2/7/07	15:17	1267718	215174			1.0	core
EW-RM-39	EW-RM07-39	EW-RM07-13	2	2/8/07	9:55	1267491	215263	1267491	215266	3.0	chemistry grab
				2/6/07	13:08	1267484	215265			7.1	core
EW-RM-40	EW-RM07-40	EW-RM07-14	2	2/8/07	13:07	1267288	215400	1267292	215401	4.1	chemistry grab
				2/6/07	14:28	1267292	215398			3.0	core
EW-RM-41	EW-RM07-41	EW-RM07-15	1	2/8/07	13:28	1267527	215525	1267525	215523	2.8	chemistry grab
EW-RM-42	EW-RM07-42	EW-RM07-16	2	2/8/07	13:38	1267483	215660	1267484	215661	1.4	chemistry grab
				2/6/07	15:03	1267485	215663			2.2	core
EW-RM-43	EW-RM07-43	EW-RM07-17	2	2/8/07	13:46	1267573	215727	1267573	215727	0.0	chemistry grab
				2/6/07	16:19	1267574	215729			2.2	core
EW-RM-44	EW-RM07-44	EW-RM07-18	2	2/8/07	14:05	1267666	215993	1267668	215994	2.2	chemistry grab
				2/6/07	15;33	1267665	215993			3.2	core
EW-RM-45[e]	EW-RM07-45[e]	EW-RM07-20	1	2/8/07	9:05	1267254	214145	1267258	214144	4.1	chemistry grab
EW-RM-46	EW-RM07-46	EW-RM07-21	2	2/8/07	10:54	1267390	214951	1267392	214951	2.0	chemistry grab
				2/7/07	13:19	1267393	214947			4.1	core
EW-RM-47	EW-RM07-47	EW-RM07-22	1	2/8/07	13:18	1267736	215415	1267737	215416	1.4	chemistry grab

[a] Zone 1 is area with no interim action, Zone 2 is area with sand layer placement, Zone 3 is mound area where gravel layer was placed

[b] Washington State Plane North, NAD83, US survey ft.

[c] Location was selected to reoccupy a location sampled in 2006

[d] Field duplicate EW-RM07-101 was collected at this location.

[e] Field duplicate EW-RM07-102 was collected at this location.

2.3 SAMPLING METHODS

Sediment cores were collected using a vibratory core sampler (vibracorer) that was able to achieve the minimum target penetration depth of 80 cm. At each sample location, total water depth and total sediment recovered were measured and recorded in the field log book. Time and date of core collection were also recorded. Cores were photographed through the clear liner, and specific details including the presence or absence of the sand layer, the depth of the sand layer, and visible organic material of each core were documented.

Surface sediment grab samples were collected with a stainless steel, 0.1-m^2 van Veen grab sampler. Before processing, each successful grab sample was evaluated for acceptability in accordance with the criteria listed in the RMP. Sediment samples for chemical analysis were collected from the 0-to-10-cm-depth interval with a clean stainless steel spoon and placed into a clean stainless steel bowl for homogenization.

2.4 FIELD DEVIATIONS FROM THE RMP

The only field deviation from the RMP (Windward 2005) was an additional grab sample collected from location EW-RM-15 due to low penetration depth at this location. Multiple grab attempts were made to achieve the desired 10cm penetration and enough volume for chemical analysis. After several failed attempts multiple grabs were collected and composited into one sample at this location. This field deviation did not affect the data quality. The protocol modification form is attached in Appendix E. There was also a deviation from the 2007 RMP memo of location ID nomenclature. The nomenclature was changed in order to easily differentiate between re-occupied locations versus new locations. This field deviation did not affect the data quality. The location ID used in the 2007 RMP memo was presented next to the actual location ID used in Table 1.

3.0 Laboratory Methods

The methods used to chemically analyze sediment samples are described briefly in this section and in detail in the EWW RMP (Windward 2005). This section also summarizes any laboratory deviations from the RMP. All chemical analyses of the sediment samples were conducted at Analytical Resources, Inc. (ARI).

3.1 ANALYTICAL METHODS

The chemical testing adhered to the most recent EPA analysis protocols which represent standard methods used for the analysis of these analytes in sediments. Table 2 summarizes the specific methods used to analyze the sediment samples.

Table 2. Chemical analysis methods for surface sediment samples

PARAMETER	METHOD	REFERENCE
PCBs as Aroclors	GC/ECD	EPA 8082
Organochlorine pesticides[a]	GC/ECD	EPA 8081A
SVOCs (including PAHs)[b]	GC/MS	EPA 8270D
Selected SVOCs by SIM[c]	GC/MS-SIM	EPA 8270-SIM
Mercury	CVAA	EPA 7471A
Other metals[d]	ICP-AES	EPA 6010B
Grain size	sieve/pipette	PSEP (1986)
TOC	combustion	Plumb (1981)
Total solids	oven-dried	EPA 160.3

[a] Target pesticides included: 4,4'-DDT, 4,4'-DDE, 4,4'-DDD, 2,4'-DDT, 2,4'-DDE, 2,4'-DDD, aldrin, alpha-BHC, beta-BHC, delta-BHC, gamma-BHC, oxychlordane, alpha- and gamma-chlordane, cis- and trans-nonachlor, dieldrin, alpha- and beta-endosulfan, endosulfan sulfate, endrin, endrin ketone, endrin aldehyde, heptachlor, heptachlor epoxide, hexachlorobenzene, methoxychlor, mirex, and toxaphene.

[b] Target PAHs included: anthracene, pyrene, dibenzofuran, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, benzo(b)fluoranthene, fluoranthene, benzo(k)fluoranthene, acenaphthylene, chrysene, benzo(a)pyrene, dibenz(a,h)anthracene, benzo(a)anthracene, acenaphthene, phenanthrene, fluorene, 2-chloronaphthalene, naphthalene, and 2-methylnaphthalene.

[c] Selected SVOCs by SIM included: 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 2,4-dimethylphenol, 2-methylphenol, benzyl alcohol, butyl benzyl phthalate, dibenzo(a,h)anthracene, dimethyl phthalate, hexachlorobenzene, hexachlorobutadiene, n-nitrosodimethylamine, n-nitrosodiphenylamine, n-nitrosodi-n-propylamine, and pentachlorophenol. Chemicals analyzed using SIM were not included in the EPA Method 8270D analyte list.

[d] Target metals included: arsenic, antimony, cadmium, chromium, copper, lead, nickel, silver, and zinc.

CVAA – cold vapor atomic absorption

GC/ECD – gas chromatograph-electron capture detection

GC/MS – gas chromatograph-mass spectrometry

EPA – US Environmental Protection Agency

ICP-AES – inductively coupled plasma-atomic emission spectrometry

PAH – polycyclic aromatic hydrocarbon

PCB – polychlorinated biphenyl

PSEP – Puget Sound Estuary Program

SIM – selected ion monitoring

SVOC –semivolatile organic compound

TOC – total organic carbon

3.2 LABORATORY DEVIATIONS FROM THE RMP

There were no laboratory deviations from the methods and procedures described in the RMP, with the following exception. The RMP lists EPA Method 9060 as the test method for total organic carbon (TOC). Plumb (1981) is the correct method reference for TOC analysis in these sediment samples.

4.0 Results

4.1 COVER LAYER VERIFICATION RESULTS

Eighteen core samples were collected in the areas where sand or gravel cover material had been placed (Zones 2 and 3) to confirm the depth of the cover layer. These results are provided in Table 3. In all core samples, at least 10 cm of sand layer were observed. At five locations (EW-RM33, EW-RM37, EW-RM39, EW-RM40 and EW-RM44) more than 2 cm of material had accumulated on top of the sand cover layer, which triggered in the collection of chemistry samples (Figure 2). In addition, at one location (EW-RM-44) the depth of the overlying material was not distinguishable so a chemistry grab was taken for this location.

Table 3. Depth of cover layer and accumulation in core samples

LOCATION ID	ZONE	SAND LAYER DEPTH (cm)	OVERLYING MATERIAL DEPTH (cm)	SURFACE SEDIMENT GRAB COLLECTED	REASON FOR CHEMISTRY GRAB
EW-RM-10	2	26	2-5	Y	predetermined in RMP
EW-RM-15	3	17	3	Y	predetermined in RMP
EW-RM-27	2	35	4	Y	predetermined in RMP
EW-RM-30	2	24	4	Y	predetermined in RMP
EW-RM-31	2	14	1.5	N	overlying material < 2 cm
EW-RM-32	2	40	2-4	Y	predetermined in RMP
EW-RM-33	**2**	**18**	**1-3**	**Y**	**overlying material ≥ 2 cm**
EW-RM-34	2	25	2-4	Y	predetermined in RMP
EW-RM-35	3	17	3	Y	predetermined in RMP
EW-RM-36	2	30	3-5	Y	predetermined in RMP
EW-RM-37	**2**	**14**	**3-5**	**Y**	**overlying material ≥ 2 cm**
EW-RM-38	3	15	2	Y	predetermined in RMP
EW-RM-39	**2**	**15**	**2.5-5**	**Y**	**overlying material ≥ 2 cm**
EW-RM-40	**2**	**15[a]**	**1.5-2.5[a]**	**Y**	**overlying material ≥ 2 cm**
EW-RM-42	**2**	**12**	**0-2.3**	**Y**	**overlying material ≥ 2 cm**
EW-RM-43	2	24	>2	Y	predetermined in RMP
EW-RM-44	**2**	**38**	**indistinguishable**	**Y**	**overlying material unknown**
EW-RM-46	2	85	2-5	Y	predetermined in RMP

RMP – 2007 recontamination monitoring plan memo

Bold and shading indicates locations where chemistry grab samples were subsequently collected because > 2cm of accumulated material was observed on top of the cover material.

[a] – based on 2nd core attempt despite not meeting required penetration or recovery since 3rd core attempt resulted in an indistinguishable sand and depositional layer

4.2 SURFACE SEDIMENT CHEMISTRY RESULTS

Surface sediment grab samples were analyzed for the full suite of SMS chemicals. The data validation, conducted by EcoChem, Inc., is discussed in Section 4.3 and presented in full in Appendix C. Complete data tables and raw laboratory data are presented in Appendices A and D, respectively. Data management protocols, including rules for the treatment of lab replicates and field duplicates as well as summation rules for total PCBs, total polycyclic aromatic hydrocarbons (PAHs) and total DDTs, are presented in Appendix B.

Appendix A presents a summary of chemistry results for the 22 EWW surface sediment samples, including the number of detections, range of detected concentrations, mean of detected concentrations, and range of reporting limits for chemicals reported and non-detects. In addition, the complete data tables containing results for each sample compared to SMS or Dredged Material Management Program (DMMP) values are presented. DMMP screening level guideline (SL) and DMMP maximum level guideline (ML) were used for 14 chemicals for which there are no available SMS.

All surface sediment samples collected from the EWW were analyzed by ARI for PCBs as Aroclors, pesticides, metals, SVOCs (including PAHs and phthalates), grain size, TOC, and percent solids. The results of the analyses are discussed below by analyte group. Table 4 presents the chemistry results that exceeded SMS. Surface sediment chemistry results represented by sediment quality standards (SQS) or cleanup screening level (CSL) categories for total PCBs, 1,4 -dichlorobenzene and mercury are presented in Figures 3 through 5, respectively.

Table 4. Sample results exceeding SMS criteria

Location ID	Sample ID	Total PCBs (mg/kg OC)		Butyl Benzyl phthalate (mg/kg OC)		1,4-Dichloro-benzene (mg/kg OC)		Mercury (mg/kg dw)	
		SQS	CSL	SQS	CSL	SQS	CSL	SQS	CSL
		12	65	4.9	6.4	3.1	9.0	0.41	0.59
EW-RM-4	EW-RM07-4	**27 J**		1.1		1.9		0.12	
EW-RM-15	EW-RM07-15	**34**		3.4 J		**<u>20</u>**		0.24	
EW-RM-27	EW-RM07-27	**26**		2.2		**3.3**		0.11	
EW-RM-29	EW-RM07-29	**60**		1.8		**8.4**		0.32	
EW-RM-30	EW-RM07-30	**22 J**		**5.4**		**<u>81</u>**		0.21	
EW-RM-32	EW-RM07-32	**31**		3.2		**<u>23</u>**		0.27	
EW-RM-34	EW-RM07-34	**<u>150</u>**		2.0		**7.7**		**0.46**	
EW-RM-35	EW-RM07-35	**23**		2.6 J		**8.6**		0.26	
EW-RM-37	EW-RM07-37	**24 J**		1.0		**3.9**		0.11	
EW-RM-38	EW-RM07-38	**21**		2.6 J		**<u>14</u>**		0.30	
EW-RM-41	EW-RM07-41	**<u>71</u>**		2.4		**3.3**		0.34	
EW-RM-43	EW-RM07-43	**12.5**		0.81		1.0		0.10	
EW-RM-44	EW-RM07-44	**23**		1.4		1.7		0.26	
EW-RM-45	EW-RM07-45	**35 J**		2.6		2.6		0.24	
EW-RM-45	EW-RM07-101	**31 J**		2.9		**3.3**		0.23	
EW-RM-47	EW-RM07-47	**29**		2.9		**4.6**		0.40	

dw – dry weight

Concentration in **bold** indicates SQS exceedance.

Concentration in **<u>bold underline</u>** indicates CSL exceedance.

CSL – cleanup screening level

OC – organic carbon

SQS – sediment quality standards

4.2.1 Conventionals: grain size, TOC, and percent solids.

TOC values ranged from 0.511% to 1.68% dry weight. The percent solids ranged from 53.8% to 82.2%. Grain size results were consistent with the placement of cover material. In Zone 1, where no cover material was placed, the sediments consisted primarily of fine to medium sand. The percent of fine material (silt + clay) was typically higher in Zone 1 sediments than in Zone 2 or 3 sediments. In Zone 2, where sand cover material was placed, sediments were typically very coarse to medium sand. Finally, in Zone 3, where gravel cover material was placed, the sediments tended to contain larger amounts of gravel.

4.2.2 PCBs as Aroclors and pesticides

Total PCBs exceeded the SQS at 15 locations (Figure 3). At two of those locations, EW-RM34 and EW-RM41, total PCB concentrations also exceeded the CSL. Pesticides were not detected in any of the samples.

4.2.3 SVOCs

No PAH results were above SMS criteria. Butylbenzyl phthalate was the only phthalate to exceed SMS criteria. At location EW-RM-30, Butylbenzyl phthalate exceeded the SQS with a concentration of 5.4 mg/kg OC (Figure 4), and 1,4--dichlorobenzene had exceedances of the SQS at 12 locations of which 4 locations also exceeded the CSL (Figure 4). No other SVOCs exceeded SMS criteria.

4.2.4 Metals

Mercury was the only metal to exceed SMS criteria. Mercury exceeded the SQS at location EW-RM34 with a concentration of 0.46 mg/kg (Figure 5).

4.3 DATA INTERPRETATION

The results of the cover layer verification sampling indicate that the depth of the cover layer was greater than 10cm at all sampling locations where cover layer thickness was measured. The results of the cover layer verification conducted in 2006 and 2007 are summarized in Table 5.

Table 5. Cover layer verification results

2006 RESULTS	2007 RESULTS
All locations had cover layer >10cm	All locations had cover layer >10cm
One location had cover layer < 20cm (EW-RM-27)	Nine locations had cover layer depths < 20cm (12-18cm)
EW-RM 10 – 24cm	EW-RM 10 – 26cm
EW-RM-27 – 17cm	EW-RM-27 – 35cm
EW-RM–15 – 23cm	EW-RM-15 – 17cm

The variability in cover material likely reflects variability in the original placement of the material as there is no consistent trend between the years for the three reoccupied locations.

In both 2006 and 2007, PCB concentrations above the CSL were reported for two locations. In 2006, 12 locations contained PCB concentrations above the SQS. In 2007, 15 locations contained PCB concentrations above the SQS. In 2006, EW-RM04 and EW-RM15, total PCB concentrations exceeded the CSL, but in 2007 they only exceeded the SQS. Pesticides were not detected in any samples in 2006 and 2007. The PCB concentrations at the three stations sampled in both 2006 and 2007 are presented in Table 6. Total PCB concentrations measured at EW-RM-04 and EW-RM-15 decreased

dramatically both in terms of dry weight concentrations as organic carbon normalized concentrations.

Table 6. Chemistry results at reoccupied stations

LOCATION	TOC (%dw)	TOTAL PCBS (µg/kg dw)	TOTAL PCBS (mg/kg OC)	BEHP (mg/kg OC)	MERCURY (mg/kg dw)
EW-RM-04 (2006)	1.54	2,600	**170**	16	0.15
EW-RM-04 (2007)	1.10	300J	**27J**	11	0.12
EW-RM-10 (2006)	0.876	200	**23**	30	**0.67**
EW-RM-10 (2007)	1.26	109	8.65	8.7	0.09
EW-RM-15 (2006)	2.30	2,400	**100**	**120**	**0.78**
EW-RM-15 (2007)	1.34	450	**34**	42	0.24

In 2006, one location contained BEHP concentrations above the CSL (EW-RM15). In 2007 no BEHP exceedances were reported. There were no butyl benzyl phthalate concentrations above the SQS in 2006 and in 2007 the concentration at EW-RM-30 exceeded the SQS. Phenol exceeded the SQS at seven locations in 2006 and no phenol exceedances were reported in 2007. In 2006, 1,4--dichlorobenzene exceedances of the SQS were reported at five locations. In 2007, 1,4-dichlorobenzene concentrations above the SQS were reported at 12 locations. Concentrations above the CSL were reported at 4 of these locations.

In 2006, locations EW-RM10 and EW-RM15 exceeded both the SQS and CSL for mercury. These stations were re-occupied in 2007 and neither location had a mercury exceedance (Table 5, Figure 5).

In summary, the concentrations of mercury in the surface sediment samples are less in 2007 samples compared to the 2006 samples. The PCB concentrations are similar but the locations with the highest concentrations in 2006 are not the same as the locations with the highest concentrations in 2007. Higher concentrations of 1,4-dichlorobenzene were measured in 2007 compared to 2006.

4.4 CHEMICAL DATA VALIDATION RESULTS

The surface sediment samples submitted to ARI were analyzed in one sample delivery group (SDG). Independent full-level data validation of this SDG (KN89) for all chemical analysis results was conducted by EcoChem. The complete data validation report is provided in Appendix C. The data validation included a review of all quality control (QC) summary forms including initial and continuing calibration, internal standard, surrogate, laboratory control sample (LCS), matrix spike (MS), and interference check sample summary forms. The majority of the data did not require qualification, or were qualified with a J, indicating an estimated value. Based on the information reviewed, the overall data quality was considered acceptable for use as

qualified. Issues that resulted in the qualification of data are summarized below. Detailed information regarding every qualified sample is available in Appendix C.

- The percent recoveries for antimony in the MS samples were 17% and 21%. The post-digestion spike recoveries of 99% and 101% were within QC limits. Antimony was never detected, and all antimony results were UJ-qualified as estimated.
- Benzoic acid, 2,4-dinitrophenol, hexachlorocyclopentadiene, and benzyl alcohol exhibited low responses in continuing calibration verifications (CCVs). These chemicals were not detected in any samples, and the results associated with the low CCVs were UJ-qualified.
- Benzo(a)anthracene and di-n-octyl phthalate had LCS recoveries below QC limits. All associated samples were J- or UJ-qualified.
- The internal standard recoveries for chrysene-d12 and perylene-d12 were above QC limits in samples EW-RM07-15, EW-RM07-35, and EW-RM07-38 resulting in the J-qualification of the detected results of butyl benzyl phthalate and dibenz(a,h)anthracene in these samples.
- The laboratory flagged several dibenz(a,h)anthracene results due to poor spectral matching, and these results were J-qualified as estimated.
- The detected concentrations of Aroclor 1260 in samples EW-RM07-45 and EW-RM07-37 were J-qualified because MS criteria were not met. Three other detected Aroclor concentrations were J-qualified because dual column concentrations exceeded 40% relative percent difference, (Aroclor 1248 in EW-RM07-30 and EW-RM07-4, and Aroclor 1254 in EW-RM07-101).
- When more than one Aroclor is present in a sample, the potential exists for a high bias from the contribution of one Aroclor to another caused by common peaks or peaks that cannot be completely resolved. Analytical peaks are selected and Aroclor identification is made based on the best resolution possible for that particular sample. Reported Aroclor concentrations were reported based on the individual Aroclors that provided the best match to the observed sample pattern.
- Most samples exhibited an analytical response above standard reporting limits (RLs) for select pesticides. These tentatively identified results were Y-qualified by the laboratory as non-detect at elevated RLs. The Y-qualifier indicates that chromatographic interference from PCB congeners in the sample prevented adequate resolution of the analyte at the standard RLs. Elevated RLs were also reported for pentachlorophenol and n-nitrosodiphenylamine because of chromatographic interferences.

- The TOC result in sample EW-RM07-37 was J-qualified as estimated because the MS recovery of 158% was above the upper QC limit of 125%.

5.0 References

Plumb R, Jr. 1981. Procedures for handling and chemical analysis of sediment and water samples. Waterways Experiment Station, US Army Corps of Engineers, Vicksburg, MS.

PSEP. 1986. Recommended protocols for measuring conventional sediment variables in Puget Sound. Prepared for the Puget Sound Estuary Program. US Environmental Protection Agency, Region 10, Seattle, WA.

Windward. 2005. East Waterway Phase 1 removal action: recontamination monitoring plan. Windward Environmental LLC, Seattle, WA.

Windward. 2007. Proposal for 2007 recontamination monitoring for EWW Memorandum, January 23, 2007. Windward Environmental LLC, Seattle, WA.